Activity Based Travel Demand Model Feasibility Study (Progress Report and Draft Outline of Future SOW)

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OBJECTIVE

The purpose of this study is to develop a transitioning multi-phased approach for a new travel demand forecasting model. The envisioned model takes advantage of the state of the practice in activity-based approaches and lays the foundation for the development of a stream of future model improvements that are more behaviorally realistic and credible, flexible in their improvement, provide answers to a variety of policy questions at multiple geographical and social scales, and can take advantage of new technologies and methods as they emerge.

The ultimate objective of the envisioned multi-phased implementation is to achieve a living map in GIS that contains models simulating every person, household, establishment, and network components (transit and highway) in the SCAG region to predict all policy relevant variables for transportation decision making and related policies such as housing and urban development.

At a minimum the model will be used for the following policy applications:

1. Regional Transportation Plan (RTP), which includes CEQA and EIR, project level impacts and system performance assessments, environmental justice (equity/equality), and visioning exercises such as smart growth.

2. Conformity analysis for RTP and for TIP.

3. County congestion management plans.

4. Major investment studies for highway and transit projects.

5. Special studies about issues related to pricing such as HOV/HOT evaluations and price sensitivity analyses.

6. Rail initiatives (high speed and commuter rail).

Note: At earlier stages of development an activity-based model is more likely to be used for policy applications that have direct impacts on activity scheduling decisions by trip makers. As the model evolves and becomes a more complete application it will start replacing the four-step model in all policy analyses.

MODEL DEVELOPMENT STAGES

Approximately one to two year-long stages of the model development are:

Phase 1: Develop a Pilot Model for the Los Angeles County. My suggestion is to create two parallel model development tasks:
Task 1: create a model based on the daily tour paradigm - pilot 1
Task 2: create a model based on the household synthetic schedule - pilot 2

(the major model components below describe this phase 1 models).

Phase 2: Expand the Phase 1 Model to the Entire SCAG region and build interfaces with other travel model components such as long distance and airport travel, heavy vehicles, service vehicles and so forth.

Phase 3: Perform an Internal and External Model Review, Validation, Redesign any Failing Components and Compare to the Four-step Model.

Phase 4: Design a new Household Survey for a New Activity-Based Model

Phase 5: Implement the Final Activity-Based Model(s)

MAJOR MODEL COMPONENTS

Figure 1 shows a schematic representation of the proposed activity-based model. It contains the blocks of models (each square contains more than one model).

External Regional Forecasts and Scenarios

This is a database manager that assembles all the needed externally provided data including the controls required for the population synthesizer.

One key component in this group of models/databases is the creation of a pricing scenario creator. Parking and tolls can change their costs by time of day, day of the week, and congestion levels.

Dynamic Population & Firm Synthesizer & Locator

Activity-based approaches are at the individual and household levels. For this reason the population of a region is synthetically generated before model application. Synthetic generation means each individual and each firm (establishment) in the region is created in software and individuals are assigned to households and dwelling units that also evolve over time and firms are assigned to parcels. It is habitual to create multiple versions of the same

population and constrain the generation of individuals and households using external information to control the distribution of population characteristics to match the external data The synthesizer provides disaggregate input data for the activity and travel models.

Available population synthesizers are static (developed for one year to coincide with the Census years 1980, 1990, 2000). Progression through time does not account for evolution of the population, residential developments and workplace supply. The envisioned population synthesis for SCAG needs to provide year-by-year transitions that meet the spatial and demographic control totals from available external data (American Community Survey, Department of Finance and other data sources) and mimics the population evolution in the region.

The synthesizer needs to also be compatible and consistent with any land use (urban, exurban, and rural) simulation model outputs. This group of models/simulation is also usable by the four-step applications.

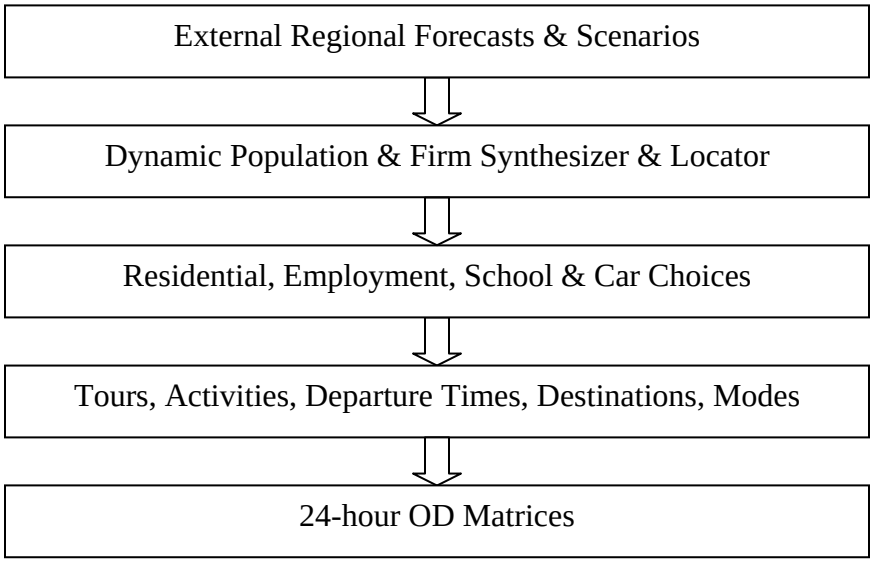

Figure 1 Schematic representation of the SCAG activity-based model

Residential, Employment, School & Car Choices

Key ingredients of activity-based models (tour-based and synthetic schedule-based) are residential, work, and school location choices. There are different options for assigning preferred locations to each household and each person within a household. It is convenient to develop primary and secondary activity

locations using available data and create a synthetic population generation model that support this capability.

Another key ingredient of the activity-based models are: car ownership and car type, car availability and car assignment within a household. All four variables are increasingly used in the four step models and in the activity-based approaches. This simulator needs to predict number of cars and car types for each household and allocate different cars to different persons of the household. It also needs to be sensitive to task allocation and changes within households.

Daily Activity and Travel Simulator

Pilot A: This model is a further improvement over the latest tour-based models using feedback from the assignment step, within household interaction outside the household interactions, and model the type of day. The modeled aspects include but are not limited to:

- Primary and secondary anchor points (Home location – work location – school location)
- Out-of-home activity purposes that include work, school, shopping, meals, personal business, recreation, and escort - or a more expanded typology
- In-home activities -heavily influenced by the data available
- Stop frequencies and activities at stops at the day pattern and tour
- Modes and destinations recognizing their mutual influence
- Departure time for trips (start of activities)
- Tour time of day choice
- Time periods between 30 minutes and minute-by-minute (this will depend on the assignment requirements)
- Time windows to account for scheduling
- Models of departure times to feed the multiple time periods for traffic assignment
- Day patterns of one person related to day patterns of another person within a household
- Joint activities and travel explicitly modeled (joint recreation, escort trips)

- Allocation of activity-roles explicitly modeled (worker, school child, home duties and so forth)

- Day of the week model system or day of the week modifiers in models

Pilot B: This model is an application of a complete household synthetic schedule generator that shares many common requirements with pilot A with the addition of time-space simulation and the impact of constraints on activity scheduling and travel, action space simulation, and duration of activities.

Note: Availability of weekend travel behavior information (weekend sample) offers the opportunity to develop weekend models and the transfer of activities from weekday to weekends.

Network Simulator

This is the component that combines OD matrices from all travel forecasts, performs assignments to different networks (highway and transit) and then produces level of service estimates that can in turn be used to compute accessibility measures to feed the models above.

Emissions Interface

Software that converts scenario output into input for emissions inventory creation.

TRAINING

As new models are created, training is needed to explain the models in a more detailed and hands-on fashion preparing planning staff in the use of these models. Some of the key topics that need to be covered in this training are: estimation of discrete choice models, estimation of discrete-continuous systems of models, synthetic population generation methods.

FACILITIES

A cluster of computers is expected to be the major need for this type of models. This is required for faster population generation, synthetic schedule generation, and traffic assignment.